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(54) Improvements in or relating to optical detecting arrangements

(57) An optical detecting arrangement for detecting movement of relatively movable parts 5, 7 to or from predetermined relative positions comprising light emitting means 1 associated with one of the parts 5 so that when the light emitting means 1 is energised the light emitted is transmitted through light transmitting means 10 associated with the other of parts 7 when the parts are located in the aforesaid predetermined relative positions whereby the transmitted light is received by light receiving means 2 associated with the one part.

The detecting arrangement is especially applicable to security systems for doors, windows, safes, etc. In such applications the emitting means may conveniently be modulated and the receiving means output synchronously detected, both being attached to a fixed member.

The arrangement may be used as a switch, wherein an optical path is made or broken by operation of the transmitting means.

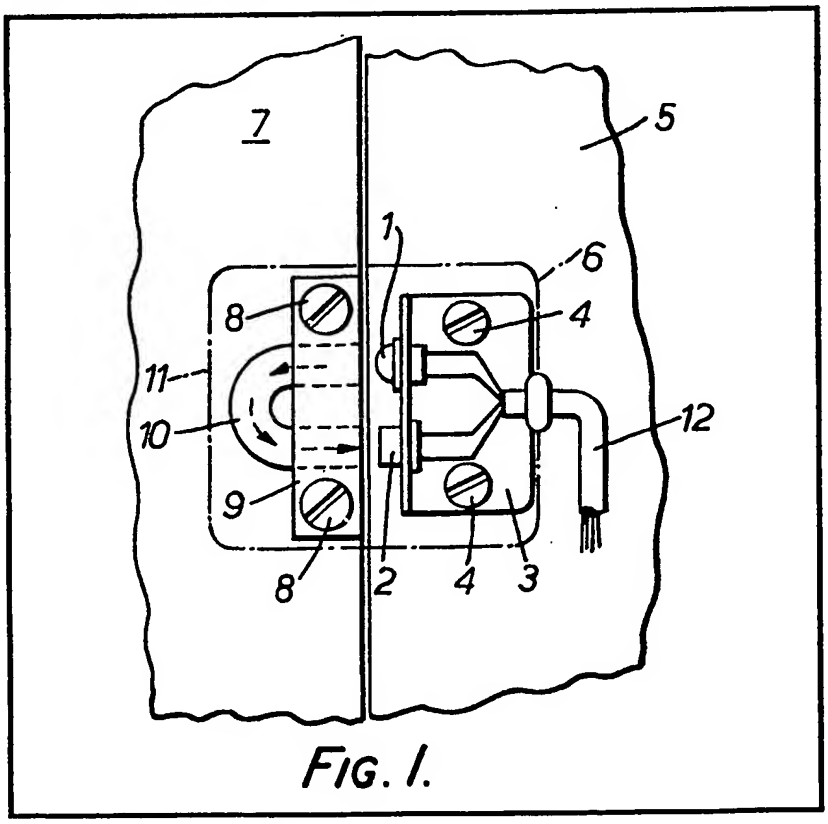

FIG. 1.

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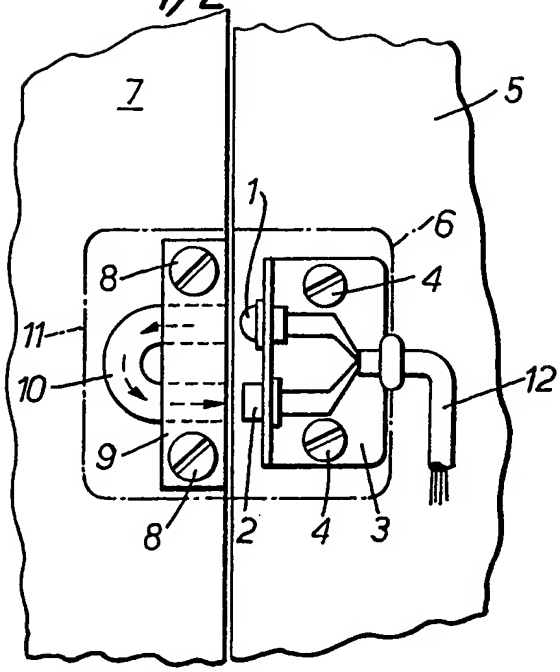

FIG. 1.

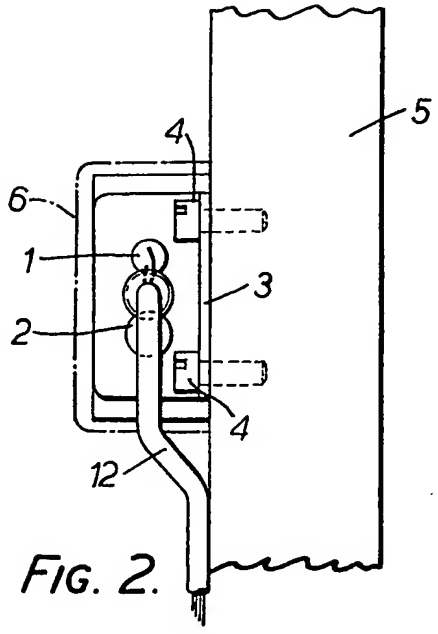

FIG. 2.

SPECIFICATION

Improvements in or relating to optical detecting arrangements

This invention relates to optical detecting arrangements and relates more specifically to such arrangements for detecting movement of relatively movable parts into or out of register with one another. For example, the present invention is especially applicable to security systems for doors, windows, safes and the like but it may be used in other applications such as to prevent operation of equipment unless relatively movable parts (e.g. removable panels and/or lid) of the equipment are in correct registration with one another.

According to the present invention there is provided an optical detecting arrangement for detecting movement of relatively movable parts to or from predetermined relatvie positions, in which light emitting means is associated with one of said parts and when energised light emitted by said means is transmitted through light transmitting means associated with the other of said parts when said parts are located in said predetermined relative positions, the transmitted light is received by light receiving means associated with said one part.

The light trasmitting means may take the form of a light guide suitably shaped (e.g. U-shaped) to convey the light from the light emitting means which may conveniently be a light emitting diode to the receiving means which may comprise a light receiving diode.

In carrying out the present invention the light emitting means and the light detecting means are preferably associated with a fixed part of the relatively movable parts in view of the cabling required for conveying electrical signals to and from the emitting and detecting means, respectively.

The light emitting diode may be energised with a signal producing a modulated light output in response to which the light receiving diode will produce a modulated signal output. This provides for security since the receiver for said output will detect an unmodulated or differently modulated signal output from the light receiving means.

An embodiment of the present invention will now be described by way of example only with reference to the accompanying drawings in which:—

Figure 1 is a fragmentary front view of a door security system having an optical detecting arrangement in accordance with the invention,

Figure 2 is a fragmentary side view of the door security system,

Figure 3 is a cross-sectional view of a switch having an optical detecting arrangement in accordance with the invention, and

Figure 4 is a view from arrows 4–4 in Fig. 3.

Referring to the drawings, the door security system, illustrated comprises a light emitting diode 1 and a receiving diode 2 both of which are mounted on a common mounting bracket 3 secured by screws 4 to a door jamb 5 shown only in part. The light emitting and detecting diodes 1 and 2 are contained within a cover 6 secured over the bracket 3. A door 7 shown only in part has secured to it by screws 8 a bracket 9 on which is mounted a U-shaped light pipe 10 which may be of quartz or plastics material located so that the respective ends of the light pipe 10 are located closely adjacent to the light emitting diode 1 and light receiving diode 2 when the door 7 is in the closed position as illustrated. The light pipe 10 and its mounting bracket 9 are enclosed by means of a cover 11. Typically, the ends of the light pipe are arranged only a few thousandths of an inch from the light emitting diode 1 and the light receiving diode 2.

The light emitting diode 1 is arranged to be excited by signal pulses at a predetermined frequency derived from a signal generating circuit (not shown) and fed to the diode 1 over cable 12. The resulting modulated light emitted by the diode 1 will enter the adjacent end of the light pipe 10 and pass therethrough into the light receiving diode 2 which accordingly produces an electrical output which is fed over cable 12 to a signal receiver (not shown). Consequently, provided the door 7 is closed as shown a signal will be received by the signal receiver and this signal may be utilised to prevent completion or closure of an alarm circuit. Should the door be opened to break the light path through the light pipe 10 or any other measure be taken to interrupt light or the light circuit, then the signal receiver will detect the absence of the modulated signal and the alarm circuit may be completed as a consequence. Since the light emitted by the light emitting diode 1 is modulated at a particular frequency (up to 1MHz) as will be the signal received by the signal receiver, any tampering with the light circuit will be detected since unmodulated light or light modulated at a different frequency entering the light circuit will result in the alarm circuit being completed anyway.

Thus different modulated frequencies representing different codes may be assigned to individial optical detecting arrangements according to the invention in order to achieve maximum security.

The invention may also be applied to security systems for windows, safes, cabinets or for car ignition and fuel supply systems or even for preventing operation of equipment such as holographic data stores to prevent operation of the equipment without removable panels and/or the lid of such equipments being in the requisite positions.

A light pipe made of acrylic plastics or quartz is extremely efficient, transmitting up

to 90% of the light supplied to it. Also the light receiving diode can be made very sensitive so that a slight reduction in light transmitted by, for example, any tampering with the device, will be immediately detected and set off an alarm circuit. Furthermore, because of the small diameter of the light pipe (e.g. 1/16 inch in diameter) very slight movements of the door 7 relative to the door jamb 5 can also be detected.

Because of the diameter of the light pipe the device can be made very small and also quickly and cheaply.

The device is also suitable for use as a switch. Such a switch is illustrated in Fig. 3 and 4.

The switch comprises a plate 20 in which is mounted a light emitting diode 21 around which are arranged four light receiving diodes 22 equidistant from the diode 21. Secured to the plate 20 is a housing 23 in which is located a rotatable member 24. The member 24 is rotated by a shaft 25 secured to the member 24 and extending through the housing 23. A U-shaped light pipe 26 is supported in the member 24 with the axis of one leg 27 of the U on the axis of rotation of the member 24. The end of the leg 27 is mounted in line with and in very close proximity with the light emitting diode 21. The other leg 28 is located the same distance from the leg 27 as the radial spacing between the light emitting diode 21 and the light receiving diodes 22.

Thus as the member 24 rotates, the leg 28 is brought successively into line with each of the light receiving diodes 22. The clearance between the end of the leg 28 and each of the light receiving diodes is again very small (of the order of a few thousandths of an inch only). The device therefore operates as a contactless switch, since any of the light receiving diodes can be energised to cause operation of some other equipment.

Such a switch will be extremely efficient being contactless and thus suffering from no wear, and being completely sealed to prevent the entry of dirt and moisture to impair the efficiency of the switch.

Various modifications can of course, be made to the arrangement, for example only two light receiving diodes may be used in a simple two way switch or a plurality of light receiving diodes may be provided. Furthermore, the member 24 could be pivoted in line with a light receiving diode and be movable so that light is received by the light receiving diode from a number of different light emitting diodes.

Furthermore, the light pipe need not be rotatable, but suitably moveable across the plate 20 into and out of register with one or more light emitting diodes and or more light receiving diodes mounted on the plate 20.

CLAIMS

1. An optical detecting arrangement for detecting movement of relatively moveable parts to or from predetermined relative positions in which light emitting means is associated with one of said parts and when energised light emitted by said means is transmitted through light transmitting means associated with the other of said parts when said parts are located in said predetermined relative positions, the transmitted light is received by light receiving means associated with said one part.

2. An optical detecting arrangement as claimed in claim 1 in which the light transmitting means is in the form of a light guide suitably shaped to convey the light from the light emitting means to the light receiving means.

3. An optical detecting arrangement as claimed in claim 2 in which the light guide is U-shaped.

4. An optical detecting arrangement as claimed in any preceding claim in which the light emitting means and the light receiving means are associated with a fixed part of the relatively moveable parts.

5. An optical detecting arrangement as claimed in any preceding claim in which the light emitting means comprises a light emitting diode and the light receiving means comprises a light receiving diode.

6. An optical detecting arrangement as claimed in claim 5 in which the light emitting diode is energised with a signal producing a modulated light output in response to which the light receiving diode produces a modulated signal output.

7. An optical detecting arrangement as claimed in any of claims 2–6 in which the light emitting means and the light receiving means are mounted on a door jamb, and the light guide is mounted on the door.

8. An optical detecting arrangement as claimed in any of claims 1 to 6 in which one or more light emitting means and one or more light receiving means are mounted on a surface and the light guide is moveable over the surface into and out of register with the one or more light emitting means, and the one or more light receiving means.

9. An optical detecting arrangement as claimed in claim 8 in which the light guide is U-shaped and pivoted on the axis of the first leg of the U-shape; light emitting means being aligned with the first leg of the U-shape and one or more light receiving means being arranged at the same distance from the light emitting means as the distance between the first and second legs of the U-shape.

10. An optical detecting arrangement constructed and adapted to operate substantially as hereinbefore described with reference to Figs. 1 and 2 or Figs. 3 and 4 of the accompanying drawings.

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